

SEQUENCE LISTING

(1) GENERAL INFORMATION:

- (i) APPLICANT: Jens Kossmann
Ruth Lorberth
- (ii) TITLE OF INVENTION: PLANTS WHICH SYNTHESIZE A MODIFIED STARCH,
PROCESS FOR THE PRODUCTION THEREOF AND MODIFIED STARCH
- (iii) NUMBER OF SEQUENCES: 4
- (iv) CORRESPONDENCE ADDRESS:
 - (A) ADDRESSEE: FISH & NEAVE
 - (B) STREET: 1251 Avenue of the Americas
 - (C) CITY: New York
 - (D) STATE: New York
 - (E) COUNTRY: USA
 - (F) ZIP: 10020
- (v) COMPUTER READABLE FORM:
 - (A) MEDIUM TYPE: Floppy disk
 - (B) COMPUTER: IBM PC compatible
 - (C) OPERATING SYSTEM: PC-DOS/MS-DOS
 - (D) SOFTWARE: PatentIn Release #1.0, Version #1.30 (EPA)
- (vi) CURRENT APPLICATION DATA:
 - (A) APPLICATION NUMBER:
 - (B) FILING DATE:
 - (C) Classification:
- (vii) PRIOR APPLICATION DATA:
 - (A) APPLICATION NUMBER: PCT/EP96/04109
 - (B) FILING DATE: 19-SEP-1996
- (vii) PRIOR APPLICATION DATA:
 - (A) APPLICATION NUMBER: DE 19547733.2
 - (B) FILING DATE: 20-DEC-1995
- (vii) PRIOR APPLICATION DATA:
 - (A) APPLICATION NUMBER: DE 19534759.5
 - (B) FILING DATE: 19-SEP-1995
- (viii) ATTORNEY/AGENT INFORMATION:
 - (A) NAME: Haley Jr., James F.
 - (B) REGISTRATION NUMBER: 27,794
 - (C) REFERENCE/DOCKET NUMBER: GFB-5
- (ix) TELECOMMUNICATION INFORMATION:
 - (A) TELEPHONE: 212-596-9000
 - (B) TELEFAX: 212-596-9090

(2) INFORMATION FOR SEQ ID NO: 1:

- (i) SEQUENCE CHARACTERISTICS:
 - (A) LENGTH: 4856 base pairs
 - (B) TYPE: nucleotide
 - (C) STRANDEDNESS: single
 - (D) TOPOLOGY: linear
- (ii) MOLECULE TYPE: cDNA to mRNA

(vi) ORIGINAL SOURCE:

(A) ORGANISM: Solanum tuberosum
(B) STRAIN: C.V. Berolina

(ix) FEATURE:

(A) NAME/KEY: CDS
(B) LOCATION: 105..4497

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 1:

CATCTTCATC GAATTTCTCG AAGCTTCTTC GCTAATTTCC TGGTTTCTTC ACTCAAATC	60
GACGTTTCTA GCTGAACCTG AGTGAATTAA GCCAGTGGGA GGAT ATG AGT AAT TCC	116
Met Ser Asn Ser	
1	
TTA GGG AAT AAC TTG CTG TAC CAG GGA TTC CTA ACC TCA ACA GTG TTG	164
Leu Gly Asn Asn Leu Leu Tyr Gln Gly Phe Leu Thr Ser Thr Val Leu	
5 10 15 20	
GAA CAT AAA AGT AGA ATC AGT CCT CCT TGT GTT GGA GGC AAT TCT TTG	212
Glu His Lys Ser Arg Ile Ser Pro Pro Cys Val Gly Gly Asn Ser Leu	
25 30 35	
TTT CAA CAA CAA GTG ATC TCG AAA TCA CCT TCA ACT GAG TTT CGA	260
Phe Gln Gln Gln Val Ile Ser Lys Ser Pro Leu Ser Thr Glu Phe Arg	
40 45 50	
GGT AAC AGG TTA AAG GTG CAG AAA AAG AAA ATA CCT ATG GAA AAG AAG	308
Gly Asn Arg Leu Lys Val Gln Lys Lys Lys Ile Pro Met Glu Lys Lys	
55 60 65	
CGT GCT TTT TCT AGT TCT CCT CAT GCT GTA CTT ACC ACT GAT ACC TCT	356
Arg Ala Phe Ser Ser Ser Pro His Ala Val Leu Thr Thr Asp Thr Ser	
70 75 80	
TCT GAG CTA GCA GAA AAG TTC AGT CTA GGG GGG AAT ATT GAG CTA CAG	404
Ser Glu Leu Ala Glu Lys Phe Ser Leu Gly Gly Asn Ile Glu Leu Gln	
85 90 95 100	
GTT GAT GTT AGG CCT CCC ACT TCA GGT GAT GTG TCC TTT GTG GAT TTT	452
Val Asp Val Arg Pro Pro Thr Ser Gly Asp Val Ser Phe Val Asp Phe	
105 110 115	
CAA GTA ACA AAT GGT AGT GAT AAA CTG TTT TTG CAC TGG GGG GCA GTA	500
Gln Val Thr Asn Gly Ser Asp Lys Leu Phe Leu His Trp Gly Ala Val	
120 125 130	
AAA TTC GGG AAA GAA ACA TGG TCT CTT CCG AAT GAT CGT CCA GAT GGG	548
Lys Phe Gly Lys Glu Thr Trp Ser Leu Pro Asn Asp Arg Pro Asp Gly	
135 140 145	
ACC AAA GTG TAC AAG AAC AAA GCA CTT AGA ACT CCA TTT GTT AAA TCT	596
Thr Lys Val Tyr Lys Asn Lys Ala Leu Arg Thr Pro Phe Val Lys Ser	
150 155 160	
GGC TCT AAC TCC ATC CTG AGA CTG GAG ATA CGA GAC ACT GCT ATC GAA	644
Gly Ser Asn Ser Ile Leu Arg Leu Glu Ile Arg Asp Thr Ala Ile Glu	
165 170 175 180	
GCT ATT GAG TTT CTC ATA TAC GAT GAA GCC CAC GAT AAA TGG ATA AAG	692
Ala Ile Glu Phe Leu Ile Tyr Asp Glu Ala His Asp Lys Trp Ile Lys	
185 190 195	

AAT	AAT	GGT	GGT	AAT	TTT	CGT	GTC	AAA	TTG	TCA	AGA	AAA	GAG	ATA	CGA	740
Asn	Asn	Gly	Gly	Asn	Phe	Arg	Val	Lys	Leu	Ser	Arg	Lys	Glu	Ile	Arg	
		200						205					210			
GGC	CCA	GAT	GTT	TCT	GTT	CCT	GAG	GAG	CTT	GTA	CAG	ATC	CAA	TCA	TAT	788
Gly	Pro	Asp	Val	Ser	Val	Pro	Glu	Glu	Leu	Val	Gln	Ile	Gln	Ser	Tyr	
		215					220					225				
TTG	AGG	TGG	GAG	AGG	AAG	GGA	AAA	CAG	AAT	TAC	CCC	CCT	GAG	AAA	GAG	836
Leu	Arg	Trp	Glu	Arg	Lys	Gly	Lys	Gln	Asn	Tyr	Pro	Pro	Glu	Lys	Glu	
	230					235					240					
AAG	GAG	GAA	TAT	GAG	GCT	GCT	CGA	ACT	GTG	CTA	CAG	GAG	GAA	ATA	GCT	884
Lys	Glu	Glu	Tyr	Glu	Ala	Ala	Arg	Thr	Val	Leu	Gln	Glu	Glu	Ile	Ala	
	245				250				255						260	
CGT	GGT	GCT	TCC	ATA	CAG	GAC	ATT	CGA	GCA	AGG	CTA	ACA	AAA	ACT	AAT	932
Arg	Gly	Ala	Ser	Ile	Gln	Asp	Ile	Arg	Ala	Arg	Leu	Thr	Lys	Thr	Asn	
			265					270						275		
GAT	AAA	AGT	CAA	AGC	AAA	GAA	GAG	CCT	CTT	CAT	GTA	ACA	AAG	AGT	GAT	980
Asp	Lys	Ser	Gln	Ser	Lys	Glu	Glu	Pro	Leu	His	Val	Thr	Lys	Ser	Asp	
			280					285					290			
ATA	CCT	GAT	GAC	CTT	GCC	CAA	GCA	CAA	GCT	TAC	ATT	AGG	TGG	GAG	AAA	1028
Ile	Pro	Asp	Asp	Leu	Ala	Gln	Ala	Gln	Ala	Tyr	Ile	Arg	Trp	Glu	Lys	
		295					300					305				
GCA	GGA	AAG	CCG	AAC	TAT	CCT	CCA	GAA	AAG	CAA	ATT	GAA	GAA	CTC	GAA	1076
Ala	Gly	Lys	Pro	Asn	Tyr	Pro	Pro	Glu	Lys	Gln	Ile	Glu	Glu	Leu	Glu	
	310					315					320					
GAA	GCA	AGA	AGA	GAA	TTG	CAA	CTT	GAG	CTT	GAG	AAA	GGC	ATT	ACC	CTT	1124
Glu	Ala	Arg	Arg	Glu	Leu	Gln	Leu	Glu	Leu	Glu	Lys	Gly	Ile	Thr	Leu	
	325				330					335					340	
GAT	GAG	TTG	CGG	AAA	ACG	ATT	ACA	AAA	GGG	GAG	ATA	AAA	ACT	AAG	GTG	1172
Asp	Glu	Leu	Arg	Lys	Thr	Ile	Thr	Lys	Gly	Glu	Ile	Lys	Thr	Lys	Val	
				345					350					355		
GAA	AAG	CAC	CTG	AAA	AGA	AGT	TCT	TTT	GCC	GTT	GAA	AGA	ATC	CAA	AGA	1220
Glu	Lys	His	Leu	Lys	Arg	Ser	Ser	Phe	Ala	Val	Glu	Arg	Ile	Gln	Arg	
			360					365					370			
AAG	AAG	AGA	GAC	TTT	GGG	CAT	CTT	ATT	AAT	AAG	TAT	ACT	TCC	AGT	CCT	1268
Lys	Lys	Arg	Asp	Phe	Gly	His	Leu	Ile	Asn	Lys	Tyr	Thr	Ser	Ser	Pro	
		375					380					385				
GCA	GTA	CAA	GTA	CAA	AAG	GTC	TTG	GAA	GAA	CCA	CCA	GCC	TTA	TCT	AAA	1316
Ala	Val	Gln	Val	Gln	Lys	Val	Leu	Glu	Glu	Pro	Pro	Ala	Leu	Ser	Lys	
	390					395					400					
ATT	AAG	CTG	TAT	GCC	AAG	GAG	AAG	GAG	GAG	CAG	ATT	GAT	GAT	CCG	ATC	1364
Ile	Lys	Leu	Tyr	Ala	Lys	Glu	Lys	Glu	Glu	Gln	Ile	Asp	Asp	Pro	Ile	
	405				410					415					420	
CTA	AAT	AAA	AAG	ATC	TTT	AAG	GTC	GAT	GAT	GGG	GAG	CTA	CTG	GTA	CTG	1412
Leu	Asn	Lys	Lys	Ile	Phe	Lys	Val	Asp	Asp	Gly	Glu	Leu	Leu	Val	Leu	
				425				430						435		
GTA	GCA	AAG	TCC	TCT	GGG	AAG	ACA	AAA	GTA	CAT	CTA	GCT	ACA	GAT	CTG	1460
Val	Ala	Lys	Ser	Ser	Gly	Lys	Thr	Lys	Val	His	Leu	Ala	Thr	Asp	Leu	
			440					445					450			

AAT CAG CCA ATT ACT CTT CAC TGG GCA TTA TCC AAA AGT CCT GGA GAG Asn Gln Pro Ile Thr Leu His Trp Ala Leu Ser Lys Ser Pro Gly Glu 455 460 465	1508
TGG ATG GTA CCA CCT TCA AGC ATA TTG CCT CCT GGG TCA ATT ATT TTA Trp Met Val Pro Pro Ser Ser Ile Leu Pro Pro Gly Ser Ile Ile Leu 470 475 480	1556
GAC AAG GCT GCC GAA ACA CCT TTT TCA GCC AGT TCT TCT GAT GGT CTA Asp Lys Ala Ala Glu Thr Pro Phe Ser Ala Ser Ser Ser Asp Gly Leu 485 490 495 500	1604
ACT TCT AAG GTA CAA TCT TTG GAT ATA GTA ATT GAA GAT GGC AAT TTT Thr Ser Lys Val Gln Ser Leu Asp Ile Val Ile Glu Asp Gly Asn Phe 505 510 515	1652
GTG GGG ATG CCA TTT GTT CTT TTG TCT GGT GAA AAA TGG ATT AAG AAC Val Gly Met Pro Phe Val Leu Leu Ser Gly Glu Lys Trp Ile Lys Asn 520 525 530	1700
CAA GGG TCG GAT TTC TAT GTT GGC TTC AGT GCT GCA TCC AAA TTA GCA Gln Gly Ser Asp Phe Tyr Val Gly Phe Ser Ala Ala Ser Lys Leu Ala 535 540 545	1748
CTC AAG GCT GCT GGG GAT GGC AGT GGA ACT GCA AAG TCT TTA CTG GAT Leu Lys Ala Ala Gly Asp Gly Ser Gly Thr Ala Lys Ser Leu Leu Asp 550 555 560	1796
AAA ATA GCA GAT ATG GAA AGT GAG GCT CAG AAG TCA TTT ATG CAC CGG Lys Ile Ala Asp Met Glu Ser Glu Ala Gln Lys Ser Phe Met His Arg 565 570 575 580	1844
TTT AAT ATT GCA GCT GAC TTG ATA GAA GAT GCC ACT AGT GCT GGT GAA Phe Asn Ile Ala Ala Asp Leu Ile Glu Asp Ala Thr Ser Ala Gly Glu 585 590 595	1892
CTT GGT TTT GCT GGA ATT CTT GTA TGG ATG AGG TTC ATG GCT ACA AGG Leu Gly Phe Ala Gly Ile Leu Val Trp Met Arg Phe Met Ala Thr Arg 600 605 610	1940
CAA CTG ATA TGG AAC AAA AAC TAT AAC GTA AAA CCA CGT GAA ATA AGC Gln Leu Ile Trp Asn Lys Asn Tyr Asn Val Lys Pro Arg Glu Ile Ser 615 620 625	1988
AAG GCT CAG GAC AGA CTT ACA GAC TTG TTG CAG AAT GCT TTC ACC AGT Lys Ala Gln Asp Arg Leu Thr Asp Leu Leu Gln Asn Ala Phe Thr Ser 630 635 640	2036
CAC CCT CAG TAC CGT GAA ATT TTG CGG ATG ATT ATG TCA ACT GTT GGA His Pro Gln Tyr Arg Glu Ile Leu Arg Met Ile Met Ser Thr Val Gly 645 650 655 660	2084
CGT GGA GGT GAA GGG GAT GTA GGA CAG CGA ATT AGG GAT GAA ATT TTG Arg Gly Gly Glu Gly Asp Val Gly Gln Arg Ile Arg Asp Glu Ile Leu 665 670 675	2132
GTC ATC CAG AGG AAC AAT GAC TGC AAG GGT GGT ATG ATG CAA GAA TGG Val Ile Gln Arg Asn Asn Asp Cys Lys Gly Gly Met Met Gln Glu Trp 680 685 690	2180
CAT CAG AAA TTG CAT AAT AAT ACT AGT CCT GAT GAT GTT GTG ATC TGT His Gln Lys Leu His Asn Asn Thr Ser Pro Asp Asp Val Val Ile Cys	2228

695	700	705	
CAG GCA TTA ATT GAC TAC ATC AAG AGT GAT TTT GAT CTT GGT GTT TAT Gln Ala Leu Ile Asp Tyr Ile Lys Ser Asp Phe Asp Leu Gly Val Tyr 710 715 720			2276
TGG AAA ACC CTG AAT GAG AAC GGA ATA ACA AAA GAG CGT CTT TTG AGT Trp Lys Thr Leu Asn Glu Asn Gly Ile Thr Lys Glu Arg Leu Leu Ser 725 730 735 740			2324
TAT GAC CGT GCT ATC CAT TCT GAA CCA AAT TTT AGA GGA GAT CAA AAG Tyr Asp Arg Ala Ile His Ser Glu Pro Asn Phe Arg Gly Asp Gln Lys 745 750 755			2372
GGT GGT CTT TTG CGT GAT TTA GGT CAC TAT ATG AGA ACA TTG AAG GCA Gly Gly Leu Leu Arg Asp Leu Gly His Tyr Met Arg Thr Leu Lys Ala 760 765 770			2420
GTT CAT TCA GGT GCA GAT CTT GAG TCT GCT ATT GCA AAC TGC ATG GGC Val His Ser Gly Ala Asp Leu Glu Ser Ala Ile Ala Asn Cys Met Gly 775 780 785			2468
TAC AAA ACT GAG GGA GAA GGC TTT ATG GTT GGA GTC CAG ATA AAT CCT Tyr Lys Thr Glu Gly Glu Gly Phe Met Val Gly Val Gln Ile Asn Pro 790 795 800			2516
GTA TCA GGC TTG CCA TCT GGC TTT CAG GAC CTC CTC CAT TTT GTC TTA Val Ser Gly Leu Pro Ser Gly Phe Gln Asp Leu Leu His Phe Val Leu 805 810 815 820			2564
GAC CAT GTG GAA GAT AAA AAT GTG GAA ACT CTT CTT GAG AGA TTG CTA Asp His Val Glu Asp Lys Asn Val Glu Thr Leu Leu Glu Arg Leu Leu 825 830 835			2612
GAG GCT CGT GAG GAG CTT AGG CCC TTG CTT CTC AAA CCA AAC AAC CGT Glu Ala Arg Glu Glu Leu Arg Pro Leu Leu Leu Lys Pro Asn Asn Arg 840 845 850			2660
CTA AAG GAT CTG CTG TTT TTG GAC ATA GCA CTT GAT TCT ACA GTT AGA Leu Lys Asp Leu Leu Phe Leu Asp Ile Ala Leu Asp Ser Thr Val Arg 855 860 865			2708
ACA GCA GTA GAA AGG GGA TAT GAA GAA TTG AAC AAC GCT AAT CCT GAG Thr Ala Val Glu Arg Gly Tyr Glu Glu Leu Asn Asn Ala Asn Pro Glu 870 875 880			2756
AAA ATC ATG TAC TTC ATC TCC CTC GTT CTT GAA AAT CTC GCA CTC TCT Lys Ile Met Tyr Phe Ile Ser Leu Val Leu Glu Asn Leu Ala Leu Ser 885 890 895 900			2804
GTG GAC GAT AAT GAA GAT CTT GTT TAT TGC TTG AAG GGA TGG AAT CAA Val Asp Asp Asn Glu Asp Leu Val Tyr Cys Leu Lys Gly Trp Asn Gln 905 910 915			2852
GCT CTT TCA ATG TCC AAT GGT GGG GAC AAC CAT TGG GCT TTA TTT GCA Ala Leu Ser Met Ser Asn Gly Gly Asp Asn His Trp Ala Leu Phe Ala 920 925 930			2900
AAA GCT GTG CTT GAC AGA ACC CGT CTT GCA CTT GCA AGC AAG GCA GAG Lys Ala Val Leu Asp Arg Thr Arg Leu Ala Leu Ala Ser Lys Ala Glu 935 940 945			2948
TGG TAC CAT CAC TTA TTG CAG CCA TCT GCC GAA TAT CTA GGA TCA ATA Trp Tyr His His Leu Leu Gln Pro Ser Ala Glu Tyr Leu Gly Ser Ile			2996

950	955	960	
CTT GGG GTG GAC CAA TGG GCT TTG AAC ATA TTT ACT GAA GAA ATT ATA Leu Gly Val Asp Gln Trp Ala Leu Asn Ile Phe Thr Glu Glu Ile Ile 965 970 975 980			3044
CGT GCT GGA TCA GCA GCT TCA TTA TCC TCT CTT CTT AAT AGA CTC GAT Arg Ala Gly Ser Ala Ala Ser Leu Ser Ser Leu Leu Asn Arg Leu Asp 985 990 995			3092
CCC GTG CTT CGG AAA ACT GCA AAT CTA GGA AGT TGG CAG ATT ATC AGT Pro Val Leu Arg Lys Thr Ala Asn Leu Gly Ser Trp Gln Ile Ile Ser 1000 1005 1010			3140
CCA GTT GAA GCC GTT GGA TAT GTT GTC GTT GTG GAT GAG TTG CTT TCA Pro Val Glu Ala Val Gly Tyr Val Val Val Val Asp Glu Leu Leu Ser 1015 1020 1025			3188
GTT CAG AAT GAA ATC TAC GAG AAG CCC ACG ATC TTA GTA GCA AAA TCT Val Gln Asn Glu Ile Tyr Glu Lys Pro Thr Ile Leu Val Ala Lys Ser 1030 1035 1040			3236
GTT AAA GGA GAG GAG GAA ATT CCT GAT GGT GCT GTT GCC CTG ATA ACA Val Lys Gly Glu Glu Glu Ile Pro Asp Gly Ala Val Ala Leu Ile Thr 1045 1050 1055 1060			3284
CCA GAC ATG CCA GAT GTT CTT TCA CAT GTT TCT GTT CGA GCT AGA AAT Pro Asp Met Pro Asp Val Leu Ser His Val Ser Val Arg Ala Arg Asn 1065 1070 1075			3332
GGG AAG GTT TGC TTT GCT ACA TGC TTT GAT CCC AAT ATA TTG GCT GAC Gly Lys Val Cys Phe Ala Thr Cys Phe Asp Pro Asn Ile Leu Ala Asp 1080 1085 1090			3380
CTC CAA GCA AAG GAA GGA AGG ATT TTG CTC TTA AAG CCT ACA CCT TCA Leu Gln Ala Lys Glu Gly Arg Ile Leu Leu Leu Lys Pro Thr Pro Ser 1095 1100 1105			3428
GAC ATA ATC TAT AGT GAG GTG AAT GAG ATT GAG CTC CAA AGT TCA AGT Asp Ile Ile Tyr Ser Glu Val Asn Glu Ile Glu Leu Gln Ser Ser Ser 1110 1115 1120			3476
AAC TTG GTA GAA GCT GAA ACT TCA GCA ACA CTT AGA TTG GTG AAA AAG Asn Leu Val Glu Ala Glu Thr Ser Ala Thr Leu Arg Leu Val Lys Lys 1125 1130 1135 1140			3524
CAA TTT GGT GGT TGT TAC GCA ATA TCA GCA GAT GAA TTC ACA AGT GAA Gln Phe Gly Gly Cys Tyr Ala Ile Ser Ala Asp Glu Phe Thr Ser Glu 1145 1150 1155			3572
ATG GTT GGA GCT AAA TCA CGT AAT ATT GCA TAT CTG AAA GGA AAA GTG Met Val Gly Ala Lys Ser Arg Asn Ile Ala Tyr Leu Lys Gly Lys Val 1160 1165 1170			3620
CCT TCC TCG GTG GGA ATT CCT ACG TCA GTA GCT CTT CCA TTT GGA GTC Pro Ser Ser Val Gly Ile Pro Thr Ser Val Ala Leu Pro Phe Gly Val 1175 1180 1185			3668
TTT GAG AAA GTA CTT TCA GAC GAC ATA AAT CAG GGA GTG GCA AAA GAG Phe Glu Lys Val Leu Ser Asp Asp Ile Asn Gln Gly Val Ala Lys Glu 1190 1195 1200			3716
TTG CAA ATT CTG ATG AAA AAA CTA TCT GAA GGA GAC TTC AGC GCT CTT			3764

Leu Gln Ile Leu Met Lys Lys Leu Ser Glu Gly Asp Phe Ser Ala Leu	
1205 1210 1215 1220	
GGT GAA ATT CGC ACA ACG GTT TTA GAT CTT TCA GCA CCA GCT CAA TTG	3812
Gly Glu Ile Arg Thr Val Leu Asp Leu Ser Ala Pro Ala Gln Leu	
1225 1230 1235	
GTC AAA GAG CTG AAG GAG AAG ATG CAG GGT TCT GGC ATG CCT TGG CCT	3860
Val Lys Glu Leu Lys Glu Lys Met Gln Gly Ser Gly Met Pro Trp Pro	
1240 1245 1250	
GGT GAT GAA GGT CCA AAG CGG TGG GAA CAA GCA TGG ATG GCC ATA AAA	3908
Gly Asp Glu Gly Pro Lys Arg Trp Glu Gln Ala Trp Met Ala Ile Lys	
1255 1260 1265	
AAG GTG TGG GCT TCA AAA TGG AAT GAG AGA GCA TAC TTC AGC ACA AGG	3956
Lys Val Trp Ala Ser Lys Trp Asn Glu Arg Ala Tyr Phe Ser Thr Arg	
1270 1275 1280	
AAG GTG AAA CTG GAT CAT GAC TAT CTG TGC ATG GCT GTC CTT GTT CAA	4004
Lys Val Lys Leu Asp His Asp Tyr Leu Cys Met Ala Val Leu Val Gln	
1285 1290 1295 1300	
GAA ATA ATA AAT GCT GAT TAT GCA TTT GTC ATT CAC ACA ACC AAC CCA	4052
Glu Ile Ile Asn Ala Asp Tyr Ala Phe Val Ile His Thr Thr Asn Pro	
1305 1310 1315	
TCT TCC GGA GAC GAC TCA GAA ATA TAT GCC GAG GTG GTC AGG GGC CTT	4100
Ser Ser Gly Asp Asp Ser Glu Ile Tyr Ala Glu Val Val Arg Gly Leu	
1320 1325 1330	
GGG GAA ACA CTT GTT GGA GCT TAT CCA GGA CGT GCT TTG AGT TTT ATC	4148
Gly Glu Thr Leu Val Gly Ala Tyr Pro Gly Arg Ala Leu Ser Phe Ile	
1335 1340 1345	
TGC AAG AAA AAG GAT CTC AAC TCT CCT CAA GTG TTA GGT TAC CCA AGC	4196
Cys Lys Lys Lys Asp Leu Asn Ser Pro Gln Val Leu Gly Tyr Pro Ser	
1350 1355 1360	
AAA CCG ATC GGC CTT TTC ATA AAA AGA TCT ATC ATC TTC CGA TCT GAT	4244
Lys Pro Ile Gly Leu Phe Ile Lys Arg Ser Ile Ile Phe Arg Ser Asp	
1365 1370 1375 1380	
TCC AAT GGG GAA GAT TTG GAA GGT TAT GCC GGT GCT GGC CTC TAC GAC	4292
Ser Asn Gly Glu Asp Leu Glu Gly Tyr Ala Gly Ala Gly Leu Tyr Asp	
1385 1390 1395	
AGT GTA CCA ATG GAT GAG GAG GAA AAA GTT GTA ATT GAT TAC TCT TCC	4340
Ser Val Pro Met Asp Glu Glu Glu Lys Val Val Ile Asp Tyr Ser Ser	
1400 1405 1410	
GAC CCA TTG ATA ACT GAT GGT AAC TTC CGC CAG ACA ATC CTG TCC AAC	4388
Asp Pro Leu Ile Thr Asp Gly Asn Phe Arg Gln Thr Ile Leu Ser Asn	
1415 1420 1425	
ATT GCT CGT GCT GGA CAT GCT ATC GAG GAG CTA TAT GGC TCT CCT CAA	4436
Ile Ala Arg Ala Gly His Ala Ile Glu Glu Leu Tyr Gly Ser Pro Gln	
1430 1435 1440	
GAC ATT GAG GGT GTA GTG AGG GAT GGA AAG ATT TAT GTC GTT CAG ACA	4484
Asp Ile Glu Gly Val Val Arg Asp Gly Lys Ile Tyr Val Val Gln Thr	
1445 1450 1455 1460	

AGA CCA CAG ATG T GATTATATTC TCGTTGTATG TTGTTTCAGAG AAGACCACAG 4537
Arg Pro Gln Met

ATGTGATCAT ATTCTCATTG TATCAGATCT GTGACCACTT ACCTGATACC TCCCATGAAG 4597
TTACCTGTAT GATTATACGT GATCCAAAGC CATCACATCA TGTTACCTT CAGCTATTGG 4657
AGGAGAAGTG AGAAGTAGGA ATTGCAATAT GAGGAATAAT AAGAAAAACT TTGTAAAAGC 4717
TAAATTAGCT GGGTATGATA TAGGGAGAAA TGTGTAAACA TTGTACTATA TATAGTATAT 4777
ACACACGCAT TATGTATTGC ATTATGCACT GAATAATATC GCAGCATCAA AGAAGAAATC 4837
CTTTGGGTGG TTTCAAAAA 4856

(2) INFORMATION FOR SEQ ID NO: 2:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 1464 amino acids
- (B) TYPE: amino acid
- (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: protein

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 2:

Met Ser Asn Ser Leu Gly Asn Asn Leu Leu Tyr Gln Gly Phe Leu Thr
1 5 10 15
Ser Thr Val Leu Glu His Lys Ser Arg Ile Ser Pro Pro Cys Val Gly
20 25 30
Gly Asn Ser Leu Phe Gln Gln Gln Val Ile Ser Lys Ser Pro Leu Ser
35 40 45
Thr Glu Phe Arg Gly Asn Arg Leu Lys Val Gln Lys Lys Lys Ile Pro
50 55 60
Met Glu Lys Lys Arg Ala Phe Ser Ser Ser Pro His Ala Val Leu Thr
65 70 75 80
Thr Asp Thr Ser Ser Glu Leu Ala Glu Lys Phe Ser Leu Gly Gly Asn
85 90 95
Ile Glu Leu Gln Val Asp Val Arg Pro Pro Thr Ser Gly Asp Val Ser
100 105 110
Phe Val Asp Phe Gln Val Thr Asn Gly Ser Asp Lys Leu Phe Leu His
115 120 125
Trp Gly Ala Val Lys Phe Gly Lys Glu Thr Trp Ser Leu Pro Asn Asp
130 135 140
Arg Pro Asp Gly Thr Lys Val Tyr Lys Asn Lys Ala Leu Arg Thr Pro
145 150 155 160
Phe Val Lys Ser Gly Ser Asn Ser Ile Leu Arg Leu Glu Ile Arg Asp
165 170 175
Thr Ala Ile Glu Ala Ile Glu Phe Leu Ile Tyr Asp Glu Ala His Asp
180 185 190

Lys Trp Ile Lys Asn Asn Gly Gly Asn Phe Arg Val Lys Leu Ser Arg
 195 200 205
 Lys Glu Ile Arg Gly Pro Asp Val Ser Val Pro Glu Glu Leu Val Gln
 210 215 220
 Ile Gln Ser Tyr Leu Arg Trp Glu Arg Lys Gly Lys Gln Asn Tyr Pro
 225 230 235 240
 Pro Glu Lys Glu Lys Glu Glu Tyr Glu Ala Ala Arg Thr Val Leu Gln
 245 250 255
 Glu Glu Ile Ala Arg Gly Ala Ser Ile Gln Asp Ile Arg Ala Arg Leu
 260 265 270
 Thr Lys Thr Asn Asp Lys Ser Gln Ser Lys Glu Glu Pro Leu His Val
 275 280 285
 Thr Lys Ser Asp Ile Pro Asp Asp Leu Ala Gln Ala Gln Ala Tyr Ile
 290 295 300
 Arg Trp Glu Lys Ala Gly Lys Pro Asn Tyr Pro Pro Glu Lys Gln Ile
 305 310 315 320
 Glu Glu Leu Glu Glu Ala Arg Arg Glu Leu Gln Leu Glu Leu Glu Lys
 325 330 335
 Gly Ile Thr Leu Asp Glu Leu Arg Lys Thr Ile Thr Lys Gly Glu Ile
 340 345 350
 Lys Thr Lys Val Glu Lys His Leu Lys Arg Ser Ser Phe Ala Val Glu
 355 360 365
 Arg Ile Gln Arg Lys Lys Arg Asp Phe Gly His Leu Ile Asn Lys Tyr
 370 375 380
 Thr Ser Ser Pro Ala Val Gln Val Gln Lys Val Leu Glu Glu Pro Pro
 385 390 395 400
 Ala Leu Ser Lys Ile Lys Leu Tyr Ala Lys Glu Lys Glu Glu Gln Ile
 405 410 415
 Asp Asp Pro Ile Leu Asn Lys Lys Ile Phe Lys Val Asp Asp Gly Glu
 420 425 430
 Leu Leu Val Leu Val Ala Lys Ser Ser Gly Lys Thr Lys Val His Leu
 435 440 445
 Ala Thr Asp Leu Asn Gln Pro Ile Thr Leu His Trp Ala Leu Ser Lys
 450 455 460
 Ser Pro Gly Glu Trp Met Val Pro Pro Ser Ser Ile Leu Pro Pro Gly
 465 470 475 480
 Ser Ile Ile Leu Asp Lys Ala Ala Glu Thr Pro Phe Ser Ala Ser Ser
 485 490 495
 Ser Asp Gly Leu Thr Ser Lys Val Gln Ser Leu Asp Ile Val Ile Glu
 500 505 510
 Asp Gly Asn Phe Val Gly Met Pro Phe Val Leu Leu Ser Gly Glu Lys
 515 520 525

Trp Ile Lys Asn Gln Gly Ser Asp Phe Tyr Val Gly Phe Ser Ala Ala
 530 535 540
 Ser Lys Leu Ala Leu Lys Ala Ala Gly Asp Gly Ser Gly Thr Ala Lys
 545 550 555 560
 Ser Leu Leu Asp Lys Ile Ala Asp Met Glu Ser Glu Ala Gln Lys Ser
 565 570 575
 Phe Met His Arg Phe Asn Ile Ala Ala Asp Leu Ile Glu Asp Ala Thr
 580 585 590
 Ser Ala Gly Glu Leu Gly Phe Ala Gly Ile Leu Val Trp Met Arg Phe
 595 600 605
 Met Ala Thr Arg Gln Leu Ile Trp Asn Lys Asn Tyr Asn Val Lys Pro
 610 615 620
 Arg Glu Ile Ser Lys Ala Gln Asp Arg Leu Thr Asp Leu Leu Gln Asn
 625 630 635 640
 Ala Phe Thr Ser His Pro Gln Tyr Arg Glu Ile Leu Arg Met Ile Met
 645 650 655
 Ser Thr Val Gly Arg Gly Gly Glu Gly Asp Val Gly Gln Arg Ile Arg
 660 665 670
 Asp Glu Ile Leu Val Ile Gln Arg Asn Asn Asp Cys Lys Gly Gly Met
 675 680 685
 Met Gln Glu Trp His Gln Lys Leu His Asn Asn Thr Ser Pro Asp Asp
 690 695 700
 Val Val Ile Cys Gln Ala Leu Ile Asp Tyr Ile Lys Ser Asp Phe Asp
 705 710 715 720
 Leu Gly Val Tyr Trp Lys Thr Leu Asn Glu Asn Gly Ile Thr Lys Glu
 725 730 735
 Arg Leu Leu Ser Tyr Asp Arg Ala Ile His Ser Glu Pro Asn Phe Arg
 740 745 750
 Gly Asp Gln Lys Gly Gly Leu Leu Arg Asp Leu Gly His Tyr Met Arg
 755 760 765
 Thr Leu Lys Ala Val His Ser Gly Ala Asp Leu Glu Ser Ala Ile Ala
 770 775 780
 Asn Cys Met Gly Tyr Lys Thr Glu Gly Glu Gly Phe Met Val Gly Val
 785 790 795 800
 Gln Ile Asn Pro Val Ser Gly Leu Pro Ser Gly Phe Gln Asp Leu Leu
 805 810 815
 His Phe Val Leu Asp His Val Glu Asp Lys Asn Val Glu Thr Leu Leu
 820 825 830
 Glu Arg Leu Leu Glu Ala Arg Glu Glu Leu Arg Pro Leu Leu Lys
 835 840 845
 Pro Asn Asn Arg Leu Lys Asp Leu Leu Phe Leu Asp Ile Ala Leu Asp
 850 855 860

Ser Thr Val Arg Thr Ala Val Glu Arg Gly Tyr Glu Glu Leu Asn Asn
 865 870 875 880
 Ala Asn Pro Glu Lys Ile Met Tyr Phe Ile Ser Leu Val Leu Glu Asn
 885 890 895
 Leu Ala Leu Ser Val Asp Asp Asn Glu Asp Leu Val Tyr Cys Leu Lys
 900 905 910
 Gly Trp Asn Gln Ala Leu Ser Met Ser Asn Gly Gly Asp Asn His Trp
 915 920 925
 Ala Leu Phe Ala Lys Ala Val Leu Asp Arg Thr Arg Leu Ala Leu Ala
 930 935 940
 Ser Lys Ala Glu Trp Tyr His His Leu Leu Gln Pro Ser Ala Glu Tyr
 945 950 955 960
 Leu Gly Ser Ile Leu Gly Val Asp Gln Trp Ala Leu Asn Ile Phe Thr
 965 970 975
 Glu Glu Ile Ile Arg Ala Gly Ser Ala Ala Ser Leu Ser Ser Leu Leu
 980 985 990
 Asn Arg Leu Asp Pro Val Leu Arg Lys Thr Ala Asn Leu Gly Ser Trp
 995 1000 1005
 Gln Ile Ile Ser Pro Val Glu Ala Val Gly Tyr Val Val Val Val Asp
 1010 1015 1020
 Glu Leu Leu Ser Val Gln Asn Glu Ile Tyr Glu Lys Pro Thr Ile Leu
 1025 1030 1035 1040
 Val Ala Lys Ser Val Lys Gly Glu Glu Glu Ile Pro Asp Gly Ala Val
 1045 1050 1055
 Ala Leu Ile Thr Pro Asp Met Pro Asp Val Leu Ser His Val Ser Val
 1060 1065 1070
 Arg Ala Arg Asn Gly Lys Val Cys Phe Ala Thr Cys Phe Asp Pro Asn
 1075 1080 1085
 Ile Leu Ala Asp Leu Gln Ala Lys Glu Gly Arg Ile Leu Leu Leu Lys
 1090 1095 1100
 Pro Thr Pro Ser Asp Ile Ile Tyr Ser Glu Val Asn Glu Ile Glu Leu
 1105 1110 1115 1120
 Gln Ser Ser Ser Asn Leu Val Glu Ala Glu Thr Ser Ala Thr Leu Arg
 1125 1130 1135
 Leu Val Lys Lys Gln Phe Gly Gly Cys Tyr Ala Ile Ser Ala Asp Glu
 1140 1145 1150
 Phe Thr Ser Glu Met Val Gly Ala Lys Ser Arg Asn Ile Ala Tyr Leu
 1155 1160 1165
 Lys Gly Lys Val Pro Ser Ser Val Gly Ile Pro Thr Ser Val Ala Leu
 1170 1175 1180
 Pro Phe Gly Val Phe Glu Lys Val Leu Ser Asp Asp Ile Asn Gln Gly
 1185 1190 1195 1200

Val Ala Lys Glu Leu Gln Ile Leu Met Lys Lys Leu Ser Glu Gly Asp
 1205 1210 1215
 Phe Ser Ala Leu Gly Glu Ile Arg Thr Thr Val Leu Asp Leu Ser Ala
 1220 1225 1230
 Pro Ala Gln Leu Val Lys Glu Leu Lys Glu Lys Met Gln Gly Ser Gly
 1235 1240 1245
 Met Pro Trp Pro Gly Asp Glu Gly Pro Lys Arg Trp Glu Gln Ala Trp
 1250 1255 1260
 Met Ala Ile Lys Lys Val Trp Ala Ser Lys Trp Asn Glu Arg Ala Tyr
 1265 1270 1275 1280
 Phe Ser Thr Arg Lys Val Lys Leu Asp His Asp Tyr Leu Cys Met Ala
 1285 1290 1295
 Val Leu Val Gln Glu Ile Ile Asn Ala Asp Tyr Ala Phe Val Ile His
 1300 1305 1310
 Thr Thr Asn Pro Ser Ser Gly Asp Asp Ser Glu Ile Tyr Ala Glu Val
 1315 1320 1325
 Val Arg Gly Leu Gly Glu Thr Leu Val Gly Ala Tyr Pro Gly Arg Ala
 1330 1335 1340
 Leu Ser Phe Ile Cys Lys Lys Lys Asp Leu Asn Ser Pro Gln Val Leu
 1345 1350 1355 1360
 Gly Tyr Pro Ser Lys Pro Ile Gly Leu Phe Ile Lys Arg Ser Ile Ile
 1365 1370 1375
 Phe Arg Ser Asp Ser Asn Gly Glu Asp Leu Glu Gly Tyr Ala Gly Ala
 1380 1385 1390
 Gly Leu Tyr Asp Ser Val Pro Met Asp Glu Glu Glu Lys Val Val Ile
 1395 1400 1405
 Asp Tyr Ser Ser Asp Pro Leu Ile Thr Asp Gly Asn Phe Arg Gln Thr
 1410 1415 1420
 Ile Leu Ser Asn Ile Ala Arg Ala Gly His Ala Ile Glu Glu Leu Tyr
 1425 1430 1435 1440
 Gly Ser Pro Gln Asp Ile Glu Gly Val Val Arg Asp Gly Lys Ile Tyr
 1445 1450 1455
 Val Val Gln Thr Arg Pro Gln Met
 1460

(2) INFORMATION FOR SEQ ID NO: 3:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 1918 base pairs
- (B) TYPE: nucleotide
- (C) STRANDEDNESS: single
- (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: cDNA to mRNA

(vi) ORIGINAL SOURCE:

- (A) ORGANISM: Solanum tuberosum

(B) STRAIN: C.V. Desiree

(ix) FEATURE:

(A) NAME/KEY: CDS

(B) LOCATION:1..1555

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 3:

GCA GAG TGG TAC CAT CAC TTA TTG CAG CCA TCT GCC GAA TAT CTA GGA Ala Glu Trp Tyr His His Leu Leu Gln Pro Ser Ala Glu Tyr Leu Gly 1 5 10 15	48
TCA ATA CTT GGG GTG GAC CAA TGG GCT TTG AAC ATA TTT ACT GAA GAA Ser Ile Leu Gly Val Asp Gln Trp Ala Leu Asn Ile Phe Thr Glu Glu 20 25 30	96
ATT ATA CGT GCT GGA TCA GCA GCT TCA TTA TCC TCT CTT CTT AAT AGA Ile Ile Arg Ala Gly Ser Ala Ala Ser Leu Ser Ser Leu Leu Asn Arg 35 40 45	144
CTC GAT CCC GTG CTT CGG AAA ACT GCA AAT CTA GGA AGT TGG CAG ATT Leu Asp Pro Val Leu Arg Lys Thr Ala Asn Leu Gly Ser Trp Gln Ile 50 55 60	192
ATC AGT CCA GTT GAA GCC GTT GGA TAT GTT GTC GTT GTG GAT GAG TTG Ile Ser Pro Val Glu Ala Val Gly Tyr Val Val Val Val Asp Glu Leu 65 70 75 80	240
CTT TCA GTT CAG AAT GAA ATC TAC GAG AAG CCC ACG ATC TTA GTA GCA Leu Ser Val Gln Asn Glu Ile Tyr Glu Lys Pro Thr Ile Leu Val Ala 85 90 95	288
AAA TCT GTT AAA GGA GAG GAG GAA ATT CCT GAT GGT GCT GTT GCC CTG Lys Ser Val Lys Gly Glu Glu Glu Ile Pro Asp Gly Ala Val Ala Leu 100 105 110	336
ATA ACA CCA GAC ATG CCA GAT GTT CTT TCA CAT GTT TCT GTT CGA GCT Ile Thr Pro Asp Met Pro Asp Val Leu Ser His Val Ser Val Arg Ala 115 120 125	384
AGA AAT GGG AAG GTT TGC TTT GCT ACA TGC TTT GAT CCC AAT ATA TTG Arg Asn Gly Lys Val Cys Phe Ala Thr Cys Phe Asp Pro Asn Ile Leu 130 135 140	432
GCT GAC CTC CAA GCA AAG GAA GGA AGG ATT TTG CTC TTA AAG CCT ACA Ala Asp Leu Gln Ala Lys Glu Gly Arg Ile Leu Leu Leu Lys Pro Thr 145 150 155 160	480
CCT TCA GAC ATA ATC TAT AGT GAG GTG AAT GAG ATT GAG CTC CAA AGT Pro Ser Asp Ile Ile Tyr Ser Glu Val Asn Glu Ile Glu Leu Gln Ser 165 170 175	528
TCA AGT AAC TTG GTA GAA GCT GAA ACT TCA GCA ACA CTT AGA TTG GTG Ser Ser Asn Leu Val Glu Ala Glu Thr Ser Ala Thr Leu Arg Leu Val 180 185 190	576
AAA AAG CAA TTT GGT GGT TGT TAC GCA ATA TCA GCA GAT GAA TTC ACA Lys Lys Gln Phe Gly Gly Cys Tyr Ala Ile Ser Ala Asp Glu Phe Thr 195 200 205	624
AGT GAA ATG GTT GGA GCT AAA TCA CGT AAT ATT GCA TAT CTG AAA GGA Ser Glu Met Val Gly Ala Lys Ser Arg Asn Ile Ala Tyr Leu Lys Gly 210 215 220	672

AAA GTG CCT TCC TCG GTG GGA ATT CCT ACG TCA GTA GCT CTT CCA TTT Lys Val Pro Ser Ser Val Gly Ile Pro Thr Ser Val Ala Leu Pro Phe 225 230 235 240	720
GGA GTC TTT GAG AAA GTA CTT TCA GAC GAC ATA AAT CAG GGA GTG GCA Gly Val Phe Glu Lys Val Leu Ser Asp Asp Ile Asn Gln Gly Val Ala 245 250 255	768
AAA GAG TTG CAA ATT CTG ACA AAA AAA CTA TCT GAA GGA GAC TTT AGC Lys Glu Leu Gln Ile Leu Thr Lys Lys Leu Ser Glu Gly Asp Phe Ser 260 265 270	816
GCT CTT GGT GAA ATT CGC ACA ACG GTT TTA GAT CTT TCG ACA CCA GCT Ala Leu Gly Glu Ile Arg Thr Thr Val Leu Asp Leu Ser Thr Pro Ala 275 280 285	864
CAA TTG GTC AAA GAG CTG AAG GAG AAG ATG CAG GGT TCT GGC ATG CCT Gln Leu Val Lys Glu Leu Lys Glu Lys Met Gln Ser Gly Met Pro 290 295 300	912
TGG CCT GGT GAT GAA GGT CCA AAG CGG TGG GAA CAA GCA TGG ATG GCC Trp Pro Gly Asp Glu Gly Pro Lys Arg Trp Glu Gln Ala Trp Met Ala 305 310 315 320	960
ATA AAA AAG GTG TGG GCT TCA AAA TGG AAT GAG AGA GCA TAC TTC AGC Ile Lys Lys Val Trp Ala Ser Lys Trp Asn Glu Arg Ala Tyr Phe Ser 325 330 335	1008
ACA AGG AAG GTG AAA CTG GAT CAT GAC TAT CTG TGC ATG GCT GTC CTT Thr Arg Lys Val Lys Leu Asp His Asp Tyr Leu Cys Met Ala Val Leu 340 345 350	1056
GTT CAA GAA ATA ATA AAT GCT GAT TAT GCA TTT GTC ATT CAC ACA ACC Val Gln Glu Ile Ile Asn Ala Asp Tyr Ala Phe Val Ile His Thr Thr 355 360 365	1104
AAC CCA TCT TCC GGA GAC GAC TCA GAA ATA TAT GCC GAG GTG GTC AGG Asn Pro Ser Ser Gly Asp Asp Ser Glu Ile Tyr Ala Glu Val Val Arg 370 375 380	1152
GGC CTT GGG GAA ACA CTT GTT GGA GCT TAT CCA GGA CGT GCT TTG AGT Gly Leu Gly Glu Thr Leu Val Gly Ala Tyr Pro Gly Arg Ala Leu Ser 385 390 395 400	1200
TTT ATC TGC AAG AAA AAG GAT CTC AAC TCT CCT CAA GTG TTA GGT TAC Phe Ile Cys Lys Lys Lys Asp Leu Asn Ser Pro Gln Val Leu Gly Tyr 405 410 415	1248
CCA AGC AAA CCG ATC GGC CTT TTC ATA AAA AGA TCT ATC ATC TTC CGA Pro Ser Lys Pro Ile Gly Leu Phe Ile Lys Arg Ser Ile Ile Phe Arg 420 425 430	1296
TCT GAT TCC AAT GGG GAA GAT TTG GAA GGT TAT GCC GGT GCT GGC CTC Ser Asp Ser Asn Gly Glu Asp Leu Glu Gly Tyr Ala Gly Ala Gly Leu 435 440 445	1344
TAC GAC AGT GTA CCA ATG GAT GAG GAG GAA AAA GTT GTA ATT GAT TAC Tyr Asp Ser Val Pro Met Asp Glu Glu Glu Lys Val Val Ile Asp Tyr 450 455 460	1392
TCT TCC GAC CCA TTG ATA ACT GAT GGT AAC TTC CGC CAG ACA ATC CTG Ser Ser Asp Pro Leu Ile Thr Asp Gly Asn Phe Arg Gln Thr Ile Leu 465 470 475 480	1440

TCC AAC ATT GCT CGT GCT GGA CAT GCT ATC GAG GAG CTA TAT GGC TCT	1488
Ser Asn Ile Ala Arg Ala Gly His Ala Ile Glu Glu Leu Tyr Gly Ser	
485 490 495	
CCT CAA GAC ATT GAG GGT GTA GTG AGG GAT GGA AAG ATT TAT GTC GTT	1536
Pro Gln Asp Ile Glu Gly Val Val Arg Asp Gly Lys Ile Tyr Val Val	
500 505 510	
CAG ACA AGA CCA CAG ATG T GATTATATTC TCGTTGTATG TTGTTTCAGAG	1585
Gln Thr Arg Pro Gln Met	
515	
AAGACCACAG ATGTGATCAT ATTCTCATTG TATCAGATCT GTGACCACTT ACCTGATACC	1645
TCCCATGAAG TTACCTGTAT GATTATACGT GATCCAAAGC CATCACATCA TGTTTCACCTT	1705
CAGCTATTGG AGGAGAAGTG AGAAGTAGGA ATTGCAATAT GAGGAATAAT AAGAAAAACT	1765
TTGTAAAAGC TAAATTAGCT GGGTATGATA TAGGGAGAAA TGTGTAAACA TTGTACTATA	1825
TATAGTATAT ACACACGCAT TATGTATTGC ATTATGCACT GAATAATATC GCAGCATCAA	1885
AGAAGAAATC CTTTGGGTGG TTTCAAAAAA AAA	1918

(2) INFORMATION FOR SEQ ID NO: 4:

(i) SEQUENCE CHARACTERISTICS:

(A) LENGTH: 518 amino acids

(B) TYPE: amino acid

(D) TOPOLOGY: linear

(ii) MOLECULE TYPE: protein

(xi) SEQUENCE DESCRIPTION: SEQ ID NO: 4:

Ala	Glu	Trp	Tyr	His	His	Leu	Leu	Gln	Pro	Ser	Ala	Glu	Tyr	Leu	Gly
1				5					10					15	
Ser	Ile	Leu	Gly	Val	Asp	Gln	Trp	Ala	Leu	Asn	Ile	Phe	Thr	Glu	Glu
	20							25					30		
Ile	Ile	Arg	Ala	Gly	Ser	Ala	Ala	Ser	Leu	Ser	Ser	Leu	Leu	Asn	Arg
	35						40					45			
Leu	Asp	Pro	Val	Leu	Arg	Lys	Thr	Ala	Asn	Leu	Gly	Ser	Trp	Gln	Ile
	50					55					60				
Ile	Ser	Pro	Val	Glu	Ala	Val	Gly	Tyr	Val	Val	Val	Val	Asp	Glu	Leu
65				70					75					80	
Leu	Ser	Val	Gln	Asn	Glu	Ile	Tyr	Glu	Lys	Pro	Thr	Ile	Leu	Val	Ala
			85						90				95		
Lys	Ser	Val	Lys	Gly	Glu	Glu	Glu	Ile	Pro	Asp	Gly	Ala	Val	Ala	Leu
			100					105					110		
Ile	Thr	Pro	Asp	Met	Pro	Asp	Val	Leu	Ser	His	Val	Ser	Val	Arg	Ala
	115						120					125			
Arg	Asn	Gly	Lys	Val	Cys	Phe	Ala	Thr	Cys	Phe	Asp	Pro	Asn	Ile	Leu
	130					135					140				
Ala	Asp	Leu	Gln	Ala	Lys	Glu	Gly	Arg	Ile	Leu	Leu	Leu	Lys	Pro	Thr
145					150					155					160

Pro Ser Asp Ile Ile Tyr Ser Glu Val Asn Glu Ile Glu Leu Gln Ser
 165 170 175
 Ser Ser Asn Leu Val Glu Ala Glu Thr Ser Ala Thr Leu Arg Leu Val
 180 185 190
 Lys Lys Gln Phe Gly Gly Cys Tyr Ala Ile Ser Ala Asp Glu Phe Thr
 195 200 205
 Ser Glu Met Val Gly Ala Lys Ser Arg Asn Ile Ala Tyr Leu Lys Gly
 210 215 220
 Lys Val Pro Ser Ser Val Gly Ile Pro Thr Ser Val Ala Leu Pro Phe
 225 230 235 240
 Gly Val Phe Glu Lys Val Leu Ser Asp Asp Ile Asn Gln Gly Val Ala
 245 250 255
 Lys Glu Leu Gln Ile Leu Thr Lys Lys Leu Ser Glu Gly Asp Phe Ser
 260 265 270
 Ala Leu Gly Glu Ile Arg Thr Thr Val Leu Asp Leu Ser Thr Pro Ala
 275 280 285
 Gln Leu Val Lys Glu Leu Lys Glu Lys Met Gln Gly Ser Gly Met Pro
 290 295 300
 Trp Pro Gly Asp Glu Gly Pro Lys Arg Trp Glu Gln Ala Trp Met Ala
 305 310 315 320
 Ile Lys Lys Val Trp Ala Ser Lys Trp Asn Glu Arg Ala Tyr Phe Ser
 325 330 335
 Thr Arg Lys Val Lys Leu Asp His Asp Tyr Leu Cys Met Ala Val Leu
 340 345 350
 Val Gln Glu Ile Ile Asn Ala Asp Tyr Ala Phe Val Ile His Thr Thr
 355 360 365
 Asn Pro Ser Ser Gly Asp Asp Ser Glu Ile Tyr Ala Glu Val Val Arg
 370 375 380
 Gly Leu Gly Glu Thr Leu Val Gly Ala Tyr Pro Gly Arg Ala Leu Ser
 385 390 395 400
 Phe Ile Cys Lys Lys Lys Asp Leu Asn Ser Pro Gln Val Leu Gly Tyr
 405 410 415
 Pro Ser Lys Pro Ile Gly Leu Phe Ile Lys Arg Ser Ile Ile Phe Arg
 420 425 430
 Ser Asp Ser Asn Gly Glu Asp Leu Glu Gly Tyr Ala Gly Ala Gly Leu
 435 440 445
 Tyr Asp Ser Val Pro Met Asp Glu Glu Glu Lys Val Val Ile Asp Tyr
 450 455 460
 Ser Ser Asp Pro Leu Ile Thr Asp Gly Asn Phe Arg Gln Thr Ile Leu
 465 470 475 480
 Ser Asn Ile Ala Arg Ala Gly His Ala Ile Glu Glu Leu Tyr Gly Ser
 485 490 495

o Gln Asp Ile Glu Gly Val Val Arg Asp Gly Lys Ile Tyr Val Val
500 505 510

Gln Thr Arg Pro Gln Met
515